

# A NEW SPECIES OF TROÖDONT DINOSAUR FROM THE LANCE FORMATION OF WYOMING

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## INTRODUCTION

The intensive search to which the Lance formation of Niobrara County, Wyo., has been subjected by fossil-hunting expeditions should seemingly have exhausted that field so far as new dinosaurian reptiles are concerned, especially the larger forms. It appears, however, that the possibilities of a field are never fully exhausted, as is attested by the recent discovery of an incomplete skull which rivals *Ankylosaurus* in size and has the massive bony, domelike enlargement of the skull, which is one of the striking characteristics of the genus *Troödon*. The large size of the specimen as well as certain differences in skull structure at once distinguishes it from the described species of this genus, all of which are from the geologically more ancient Judith River and Belly River formations. The discovery of more perfect material in the Lance may disclose characters that will necessitate the founding of a new genus, but for the present I shall refer the specimen to the genus *Troödon*, and propose the name *wyomingensis* to designate the species.

The occurrence of *Troödon* in the Lance fauna was reported by the late J. B. Hatcher<sup>1</sup> in 1905. In the article cited, under the heading *Troödon validus*, he says: "Teeth of a very similar size and pattern are not uncommon in the Laramie [Lance] of Converse [now Niobrara] County, Wyo." The discovery of the present specimen is therefore in a way corroborative of Hatcher's observations of 25 years ago.

## Family TROÖDONTIDAE, 1924

### Genus TROÖDON, 1856

#### TROÖDON WYOMINGENSIS, new species

Plates 1, 2, and 3

*Type*.—U.S.N.M. No. 12031; consists of the upper posterior half of the skull, including the occipital region downward nearly to the foramen magnum.

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<sup>1</sup> Hatcher, J. B., U. S. Geol. Survey Bull. 257, p. 82, 1905.

Collected by George F. Sternberg, August 25, 1930.

*Type locality*.—About 9 miles SW. of Warren P. O., Buck Creek, Niobrara County, Wyo.

*Horizon*.—Lance formation, Upper Cretaceous.

The specimen includes most of the upper half of the back portion of the skull. The occipital border and the lateral border of the left side forward of the infratemporal fenestra are preserved, thus furnishing the full posterior width of the skull. Anteriorly the skull is abruptly broken off back of the median prolongation of the frontals. The median part of the massive dome was broken down prior to discovery and much of its upper surface is missing, but enough of the surrounding area remains to give a fairly accurate conception of the full shape and extent. For the purpose of illustration the missing part of the dome has been carefully modeled, following the contours of the original adjacent surfaces, with the result shown in Plate 1, Figure 1.

The cranium-shaped enlargement is the outstanding feature of the *Troödon* skull, the elevation having the form of a subovate boss (pl. 2, fig. 2), that reaches its maximum height posterior to the line of the orbits. At the center above the brain the estimated thickness is not less than 180 mm. The central swelling is broadly convex transversely but more moderately so in a longitudinal direction. That this specimen is of a fully adult individual is indicated by the coalescence of all sutures, few of which can now be distinguished.

The dome surface is perfectly smooth and lacks the foramina and markings so characteristic of the *T. validus* skulls. Fractured surfaces show the internal bone to be very dense as contrasted with the more or less porous structure of the Belly River *Troödonts*. The differences pointed out may, however, be only an age characteristic.

Viewed from above, the outline of the skull ends rather squarely behind. At the base of the domelike enlargement, a broad shelf, strongly overhanging the occiput, extends backward. The upper surface of this shelf is only slightly less steeply inclined than the surface of the dome itself. Thus, in profile it is quite unlike *T. validus*, in which the shelf forms nearly a right angle with the dome mass. (Compare figs. 1 and 2, pl. 1.) The median part of the parietal surface is devoid of ornamentation, as is the whole heavy, rounded occipital border, in striking contrast to the ornate surface of the *T. validus* skull. On either side of the smooth area, in the position of the supratemporal fossae, is a large cluster of rounded protuberances. Since parts of the skull are missing from both sides, complete detailed information of this ornamentation is not available. These rounded nodes have the appearance of each being on the basal end of separate angularly cone-shaped ossifications that together completely fill the supratemporal fossa. In fact, it is clearly

indicated that the boundary of this opening on the posterior side is formed by an outwardly directed process of the parietal joining an inwardly directed process of the squamosal, as is usual in other dinosaurian skulls.

The bone structure of these dermal ossifications appears distinctive of the Troödont dinosaurs, and on that account is worthy of detailed description. Each of the sections from the supratemporal area that are surmounted by a rounded node fractures downward taperingly to more or less of a point. The bone fibers of these broken surfaces concentrate at a focal point at this lower end, which no doubt explains the reason for the similarity of the fractures. A somewhat similar radiating structure was noted on the broken surfaces of the dome mass before the pieces were cemented together. This fact leads to the suggestion that the dome, after all, may not be a thickening of the parietal and frontal bones, as formerly thought, but is a concentration of a series of dermal ossifications that have become fused, not only to one another but to the underlying skull elements. Further evidence favoring such an interpretation is found in Troödont skulls studied by Lambe,<sup>2</sup> in which he notes that the structure of the bone forming the dome is columnar in section.

On the left side of the specimen the squamosal and much of the postfrontal are present, but they are so fully coalesced, not only with one another but with the adjacent skull elements, that their extent and limitations can no longer be determined. The squamosal is exceedingly massive and apparently forms the whole of the posterior external angle of the skull. Its upper external surface is sparsely covered with low, rounded tubercles of varying size, but below and in front of these the bone surface is lumpy but otherwise smooth. The upper surface of the postfrontal forms a narrow shelf along the lateral base of the dome. Whether the squamosal also contributes to the formation of this shelf can not be determined. The outer edge is rounded, not raised as in *T. validus*. On the under side the squamosal is cupped for the reception of the quadrate head, which is missing in this specimen. Back of this cotylus a heavy, slightly curved, bluntly pointed process represents the posterior overhang of the squamosal. All of the skull elements, including a forward portion of the postfrontal bone, are missing. The smooth but pitted areas that form the roof of the orbital cavities are preserved on the ventral side (pl. 3, fig. 2), and these accurately indicate the position of the orbits.

When the top of the orbital roof and the upper boundary of the infratemporal fossa coincide on a horizontal line the upper part of

<sup>2</sup> TRANS. ROY. SOC. CANADA, ser. 3, vol. 12, p. 24, 1918.

the occiput occupies a nearly horizontal plane. The occipital region from a point somewhat above the position of the foramen magnum is in a good state of preservation. At the center a flattened triangular area that narrows ventrally represents the supraoccipital bone. Unfortunately, as in other parts of the skull, the sutures are all obliterated. The smoothness of this central area is quite unlike the deeply concave surface of the *T. validus*<sup>3</sup> skull, which has a low sharp vertical ridge at the center.

On either side lateral to this flattened central area are the wing-like expanded processes of the paraoccipitals, which are directed strongly outward and backward, their outer ends passing smoothly into the posterior branch of the squamosals.

#### MEASUREMENTS

	Mm.
Greatest width of skull across squamosals.....	310
Distance from center of orbital roof to rear of skull.....	244
Greatest width of dome mass.....	275
Greatest thickness about.....	180

*Troödon wyomingensis* may be at once distinguished from the known species of the genus by its much larger size. Judging by the few skull measurements obtainable, the type specimen is more than twice the size of the largest *T. validus* cranium known from the Belly River formation. It is further distinguished by the complete closure, by dermal bones, of the supratemporal fossae, the smooth unsculptured surface of the dome, and the simpler ornamentation of the cranium throughout. From *T. validus* Lambe it differs further in having a flattened supraoccipital area without a median ridge, and a more steeply inclined parietal region posterior to the dome, the latter making quite a difference in profile when viewed from the side, as is clearly shown by comparing Figures 1 and 2, Plate 1.

#### NOTES ON REFERRED SPECIMEN

In Plate 4, Figures 1 and 2, are illustrated two incomplete bones, U.S.N.M. No. 7806, that were collected from the Lance formation of Niobrara County, Wyo., by J. B. Hatcher in 1890. It has long been suspected that these fragmentary parts pertained to some undescribed member of the Lance fauna, and on that account they have been shown to practically all visiting paleontologists. Up to this time no one would hazard a guess as to their origin. It was quite generally agreed that they were dermal ossifications, one of which was ornamental in character. With the acquisition of the skull of *Troödon wyomingensis* their origin seems to be explained.

<sup>3</sup> Gilmore, Charles W., Bull. No. 1, University of Alberta Press, p. 21, 1924.



The ossification illustrated in Plate 4, Figure 1, is quite certainly an ornamental dermal bone having a compressed upper extremity whose edge is serrated with toothed denticles. That it was in contact with another of perhaps similar shape is indicated by a sutural surface at one end. The broken basal portion shows that the striation of the bone radiates from a focal point near the lowermost pointed end. Precisely the same type of structure is to be observed in the bone filling the supratemporal opening of the *T. wyomingensis* skull, and for that reason I am of the opinion that this fragment represents a dermal ornament of a *Troödon* skull. If these deductions are correct it shows the presence of a type of ornamentation unknown in the earlier *Troödonts*.

The second fragmentary piece, Plate 4, Figure 2, shows a similar radiating structure, but as yet I am unable to hazard a guess as to what part of the animal it may represent. The bone is especially dense and heavy and the external side is peculiarly roughened.

A fragment (pl. 5, fig. 1), U.S.N.M. No. 8795, included in a small lot of miscellaneous dinosaur armor plates collected by Charles H. Sternberg, in Niobrara County, Wyo., is quite certainly a portion of the squamosal of a *Troödont* dinosaur. This is indicated not only by the thick, rounded protuberances of the dorsal surface but also by the deep suture at one end, a feature that is peculiarly characteristic of the cranial elements of the *Troödont* skull.

These fragmentary parts, briefly described, give evidence of at least two individuals beside the type, and no doubt others will now be recognized among the miscellaneous bones from this formation in other collections.

#### NOTE ON *TROÖDON FORMOSUS* LEIDY

The above genus and species were established by Leidy,<sup>4</sup> on the crown of a single tooth from the Judith River formation of Montana. In the years that have elapsed since this first discovery a few other detached teeth have been found in this same formation. These constitute the only known materials referable to the present species. Recently in looking over some fragmentary dinosaurian specimens in the paleontological collections of the National Museum, I came across a fragmentary portion of a skull that was at once recognized as pertaining to the genus *Troödon*. (See pl. 5, fig. 2.) This specimen was collected by J. B. Hatcher, July 7, 1888, from the Judith River beds on Cow Island, Mont., a place not far removed from the type locality. It would therefore seem fair to infer that it belongs to the species *T. formosus* Leidy. If this assignment is correct it furnishes the first information on this species other than from teeth.

<sup>4</sup> Proc. Acad. Nat. Sci. Philadelphia, vol. 8, p. 72, 1856.

The specimen consists principally, if not entirely, of the frontal bones, which display the characteristic thickening that forms a dome above the brain. In size it agrees very closely with the partial skull described by Lambe<sup>5</sup> as *T. validus* from the Belly River of Alberta. In size, thickness of dome, surface sculpturing, and in the ventral view showing the contribution to the walls of the orbit and brain case, the two specimens, so far as they can be compared, appear to be identical. A question is thus raised as to the distinctness of the two species. The materials in hand are not yet sufficient for a positive determination of this point, but in the light of this fragmentary specimen, the possibility of their being one and the same thing is indicated. In that event, *T. validus* would become a synonym of *T. formosus*, which has priority by many years.

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<sup>5</sup> Trans. Roy. Soc. Canada, ser. 3, vol. 12, pl. 1, fig. 1, 1918.